Assessment of EMR Adoption Model developed by Health Information Management Systems Society for an EMR Software

By

Archit Karnik

Dissertation submitted for the partial fulfillment of the

MBA Hospital and Health Management

Academic year, 2015-2017

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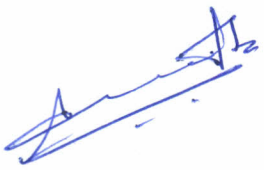

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ABSTRACT

Objective: The aim of this study is to conduct a systematic review of literature to understand the Electronic Medical Record Adoption Model developed by HIMSS for US Healthcare and the pre-requisites for complying with the multiple stages of the model and asses an EMR software. The study also aims to measure the compliance of a healthcare provider under the client market based on the EMR Adoption Model and its stages functioning on the assessed software.

Methodology: A comprehensive literature search was performed to study electronic medical records model from research articles, whitepapers and the information provided by HIMSS Analytics. Study majorly focuses on the North American market segmented into four zones from which one of the largest patient base hospital is studied for the EMR software and the EMRAM stages respectively.

Results: After the comprehensive study of the EMR Adoption Model based on the literature, review shows that the EMR software assessed based on the pre-requisites is completely compliant with the EMRAM stages and is robust enough to comply with and achieve all seven stages of the model. The study also infers that the hospital studied from the client market is assessed based on the reports that were run based on the end users credentials and the four compliance parameters suggested by HIMSS analytics is compliant with three of them and is yet to achieve one of the four parameters and achieve stage seven.

Conclusion: The Electronic Medical Records Adoption Model provides a basis for the integration of technology with healthcare services by providing a medium for assisting all the stakeholders at every stage of the model. In transition from basic ancillary services to creating a completely paperless environment, which facilitates to improve the delivery of healthcare services, enhances the efficiency of operations and provides a concrete basis for patient medication and treatment since software functioning is driven by evidence of data in software.Following the EMRAM model apart from enabling a paperless environment, creates a standardized platform for the healthcare providers worldwide for the adaption of model. Simultaneously, the model also has incentives associated and a recognition attached for reaching stage 7, which drives the healthcare providers in US for adaption of EMR Model and setting a benchmark for making the entire health systems robust and efficient.

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Archit Karnik

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ABBREVIATIONS

1.	EMR	Electronic Medical Records
2.	ARRA Act	American Recovery and Reinvestment Act
3.	HITECH Act	Health Information Technology for Economic and Clinical Health
4.	IP	Inpatient
5.	OP	Outpatient
6.	HIMSS	Health Information Management Systems Society
7.	CDR	Clinical Data Repository
8.	CDSS	Clinical Decision Support Systems
9.	CDO	Care Delivery Organization
10.	CCD	Continuity of Care Document
11.	PACS	Picture Archive and Communication Systems
12.	CPOE	Computerized Physician Order Entry
13.	RFID	Radio Frequency Identification
14.	HCO	Health Care Organization
15.	HIE	Health Information Exchange
16.	HRO	High Reliability Organization
17.	ROI	Return on Investment
18.	CIO	Chief Information Officer
19.	ED	Emergency Department
20.	NICU	Neonatal Intensive Care Unit
21.	BCMA	Barcoded Medication Administration
22.	CMS	Centers for Medicare & Medicaid Services
23.	MU	Meaningful Use
24.	SNOMED-CT	Systematized Nomenclature of Diseases-Clinical Terms
25.	LOINC	Logical Observations Identifiers Name and Codes
26.	ICD	International Classification of Diseases

1. Introduction

The development of information technology in health is directed to reduce medical errors, promote improved quality and efficiency of care. Investment in HIT tools has been a significant area of investment by the Healthcare organizations in recent years. Electronic Medical Records are one such technological advance in healthcare, which are defined as personal data records maintained, developed, and/or provided by clinicians, and providers in direct patient care.

For improving the communication among various providers within and between the organizations, EMRs are developed which serve by automating the collection, use and storage of patient information and facilitates clinical decision support and guidelines compliance. Evidence from various studies prove that various multiple functionalities of EMR such as Clinical Decision Support System, Clinical Data Repository and Computerized Physician Order Entry helps in improving the quality by reducing medical errors. Analysis have also revealed that improved patient safety, high quality care and cost reduction based on the overall spending of health information technology has encouraged the adoption of electronic medical records.

2. Literature Review

A primary research was conducted based on the checklist for comparison of the EMR software with the EMR Adoption Model developed by the Health Information Management Systems Society to find the exact reasons for standardization & to focus on secondary data based on literature review.

On secondary research front, a literature search was performed to identify published studies related to the views on electronic medical records, adaption needs & benefits associated. The search was limited to full paper research articles published. However, this review gives a broad reflection of substantial research performed across different regions/market in the US.

In theory, any information that can be placed in a paper record can also be placed in an electronic record. However, many institutions that are migrating toward an electronic record system are facing some challenges such as difficulty in converting unstructured text, data, and images into a standard format.

Different types of patient data that can be included in an EMR system:

- Medical history of patient
- Physical examination
- Diagnosis
- Activities related to clinical work
- Diagnostic assessment
- Therapeutic efficacy (drugs, devices, procedures, rehabilitation programs)
- Data related to administration (Claims, billings, outcomes)

Benefits of using EMR systems are expected to include:

- Minimum medical errors, which are estimated to be responsible for as many as 44,000 to 98,000 deaths a year
- More efficient healthcare delivery services provision
- Reduced utilization
- Ability to manage chronic disease

In addition, it has also been estimated that adoption of electronic records could cut 10% or more from the nation's $1.7 trillion each year in healthcare spending by the reduction in handling of paper records and unnecessary or duplicative tests elimination is an enormous cost savings.

In theory, storage of patient medical information electronically in an EMR provides various advantages over paper records, such as:

First, files in the electronic format can be accessed readily from anywhere, local or remote, within a communications link or network. Data can be retrieved easily if stored electronically. If the database has been, designed appropriately and indexed millions of records can be shifted through in seconds. At a time, multiple users can have access to those records and all service providers can share the same records.

Second, in order to create a single record for individuals records that are created by multiple providers from different locations and units can be linked and shared. The information of patient care can be shared among various healthcare providers and the record fragmentation problem can also be resolved.

Third, different data views can be displayed by well-designed, computerized records for example, all the recent medications or issues; graphical display of the last 10 full blood counts; or results of various tests for an admission or date range..

Fourth, streamlined reporting functions for electronic records.

Despite of all the hurdles, still the adoption rates of EMR may be increasing, however, and in future, it is expected that the growth will increase significantly. For example, although only 18 percent of respondents in a Healthcare Information and Management Systems Society (HIMSS) survey of 253 information officers representing 550 hospitals report a fully operational EMR in place at their organization, nearly two-thirds indicated they have either developed a plan to implement an EMR system or they have begun to install EMR hardware and software, and more than half of U.S. hospitals plan to add EMRs in the next two years.[1]

HIMSS Analytics is an advisor of global healthcare that is providing guidance and market intelligence solutions that encouraging industries to move forward with insight to enable better healthcare delivery with IT.

It is a trusted healthcare research and advisory firm, helps in improving decision-making related to roadmap of IT strategy and market strategy depends on HIMSS Analytics' resources, benchmarks, predictive models and assessment tools.

Healthcare Information and Management Systems Society (HIMSS) is an American non-profit organization helps in improving quality, safety, security, cost-effectiveness, and access in healthcare with the efficient use of information technology and management systems.

A wholly owned subsidiary of HIMSS, the HIMSS Analytics is the healthcare research and advisory firm for healthcare delivery organizations, IT companies, governmental entities, financial, pharmaceutical, consulting and emerging technology solution partners worldwide.

EMRAM

Around the world, the journey to Electronic Medical Record (EMR) adoption produces countless benefits including organizational efficiency and positive return on investment for both hospitals and outpatient clinics.

Healthcare providers cite a decrease in the number of staff required for both medical records management and clinical care delivery after they go live with their EMR. The advantages brought by availability and sharing of health information produces a significant amount of time and money saved.

The HIMSS Analytics EMR Adoption Model (EMRAM) measures the adoption and utilization of EMRs. The process ensures effective prioritization of functionality roll out to improve the efficiency of healthcare delivery.[2]

Patient's medical information can be portable and available to his or her clinicians at the time of treatment if there is an interoperability and facility of healthcare information exchange in the system, at least to the extent that the patient wants it to be. If there is no interoperability and health information exchange, then the healthcare information will remain in proprietary silos, and this will increase healthcare enterprises hopes in order to gain comparative advantage by imposing high costs on patient and also by exercising market advantage as solo physicians and community hospitals over small niche players.[3]

The reduced length of stay associated with EMR suggests that EMR might allow faster tests, medications and procedures ordering by physician, speed up the process/discharge scheduling, and service ordering process delay reduction. In addition, EMR may also contributes in reducing length of stay through faster and accurate communication and coordination among providers.[4]

3. Problem Justification

Despite of the existence of standards & measures there are certain loopholes, which affect the delivery of healthcare services to the clients & hinders the image of health service facilities in terms of their sustainability & growth.

The focus area in the study are not only in terms of improvement of technology or economical services but should also extend its coverage towards the applicability of systematic & sequentially arranged processes to have a streamlined and robust use of the available systems.

4. Rationale

Most of the reviews demonstrate a positive perception with respect to the adaptability of electronic medical records by the healthcare providers owing to various factors such as efficiency, quality, safety etc. The goal of the project is to study the Electronic Medical Records Adoption Model developed by the Health Information Management Systems Society in context of US Healthcare, simultaneously compare the model with an EMR software and hospitals in the client market based on the data inferred from the model. The following information may support the management to understand the pitfalls & improve the organizational efficiency.

5. Research Questions

- What is the adaptability prerequisites of electronic medical records model in US hospitals?
- What factors are associated with the software that healthcare providers operate across US market for moving to paperless environment?

6. Objective

- To study the EMR Adoption Model with respect to US Healthcare
- To assess the capability of an EMR Software for complying with the pre-requisites of EMR Adoption Model
- To assess hospitals from the client market for EMR model adoption and provide recommendations for stage up gradation

7. Methodology

7.1 Research Design

Research designed as a Qualitative Study involving Descriptive Cross-sectional Study design. The method of data collection includes observatory understanding and discussions based on certain study points for analysis.

7.2 Study Setting

Study carried out for the North American market distributed as North Zone, Central Zone and South Zone of The United States of America, where the client with respect to the EMR Adoption Model implemented the software studied.

7.3 Sampling

For the Qualitative analysis, Convenience sampling technique under Non-Probability sampling.

7.4 Sample Size

The sample was selected as a “single healthcare facility”. The study subject was selected from one of the four market regions of the client operations based on convenient sampling.

7.5 Study Tool

For data collection, a checklist from the Electronic Medical Records Adaption Model (EMRAM) was prepared. Data collected by interviewing the software users with specific discussion based on every technical and non-technical functionality of the model. The report represents a comparative analysis of the data collected in masked format.

7.6 Study limitations

Confidentiality clause for the non-disclosure of:

- EMR software and its specifications
- Client market
- Healthcare provider studied

8. Findings

The study based on the above research questions revealed the following findings:

8.1 To study the EMR Adoption Model with respect to US Healthcare

Electronic Medical Records Adoption Model

HIMSS Analytics has been developed a methodology and algorithms in order to provide comparisons for CDOs as their strategic path is complete EMR and also participation in an EHR for automatically scoring the approximately 4,000 hospitals in their database relative to their IT-enabled clinical transformation status.

The stages of the model are as follows:

Stage 0: Some clinical automation may be present, but any of the three major ancillary department systems i.e. laboratory, pharmacy, and radiology are not implemented.

Stage 1: All three of the major ancillary clinical systems are installed (i.e., pharmacy, laboratory, radiology).

Stage 2: Major ancillary clinical systems feed data to a clinical data repository (CDR) that provides physician access for retrieving and reviewing results. The CDR contains a controlled medical vocabulary and the clinical decision support/rules engine for rudimentary conflict checking. Information from document imaging systems linked to the CDR at this stage.

Stage 3: For at least one service in hospital clinical documentation (e.g. vital signs, flow sheets) is required; nursing notes, care plan charting, and the electronic medication administration record (eMAR) system are scored with extra points, implemented and integrated with the CDR.

The implementation of first level of clinical decision support to conduct error checking with order entry (i.e., drug/drug, drug/food, drug/lab conflict checking normally found in the pharmacy). Some level of medical image access from picture archive and communication systems (PACS) is available for access by physicians via the organization s intranet or other secure networks outside of the radiology department confines.

Stage 4: Addition of Computerized Practitioner/Physician Order Entry (CPOE) for use by any clinician to the nursing and CDR environment along with the second level of clinical decision support capabilities related to evidence based medicine protocols. Consideration of stage as achieved if one patient service area has implemented CPOE and completed the previous stages.

Stage 5: Complete implementation of closed loop medication administration environment in at least one patientcare service area. The eMAR and bar coding or other auto identification technology, such as radio frequency identification (RFID), are implemented and integrated with CPOE and pharmacy to maximize point of care patient safety processes for medication administration.

Stage 6: Implementation of full physician documentation/charting (structured templates) for at least one patientcare service area. Level three of clinical decision support provides guidance for all clinician activities related to protocols and outcomes in the form of variance and compliance alerts. A full complement of radiology PACS systems provides medical images to physicians via an intranet and displaces all film-based images.

Stage 7: The hospital has a paperless EMR environment. Sharing of clinical information via electronic transactions or exchange of electronic records with all entities within a regional health network (i.e., other hospitals, ambulatory clinics, subacute environments, employers, payers and patients). This stage allows the HCO to support the true electronic health record as envisioned in the ideal model.

Representation of EMR Environment

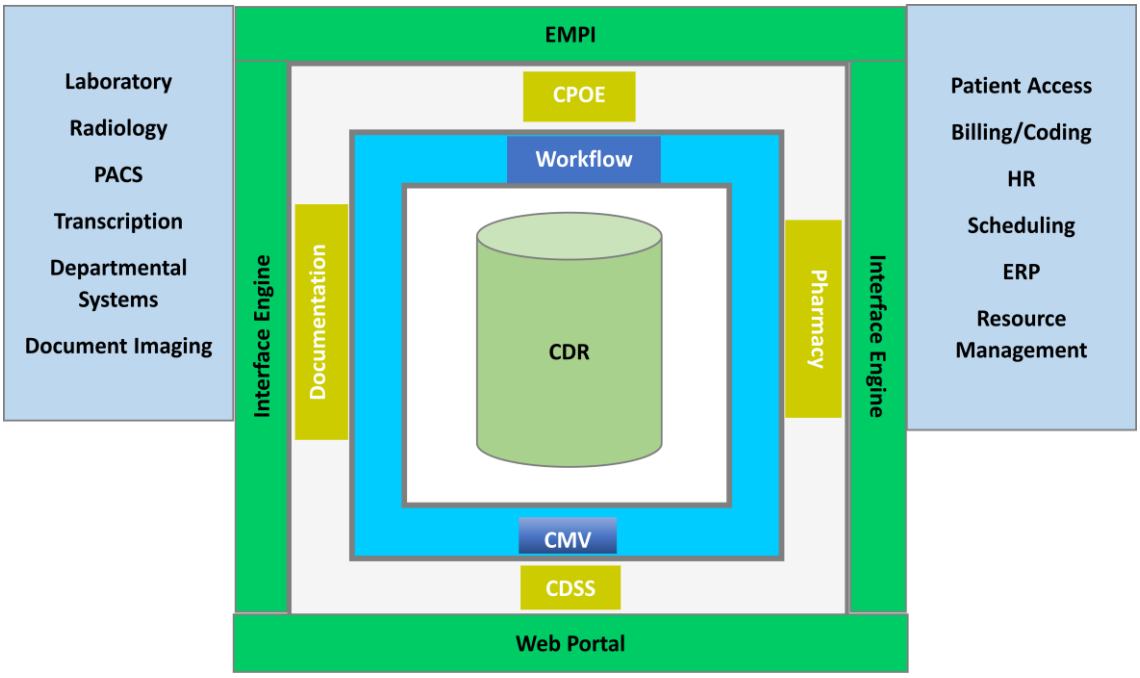


Figure: 8.1

This EMR Adoption Model typically designed by the analytics division of Healthcare Information Management Systems Society in order to track the progress of implementation of various EMR solutions and its advanced functionalities in inpatients and ambulatory hospitals

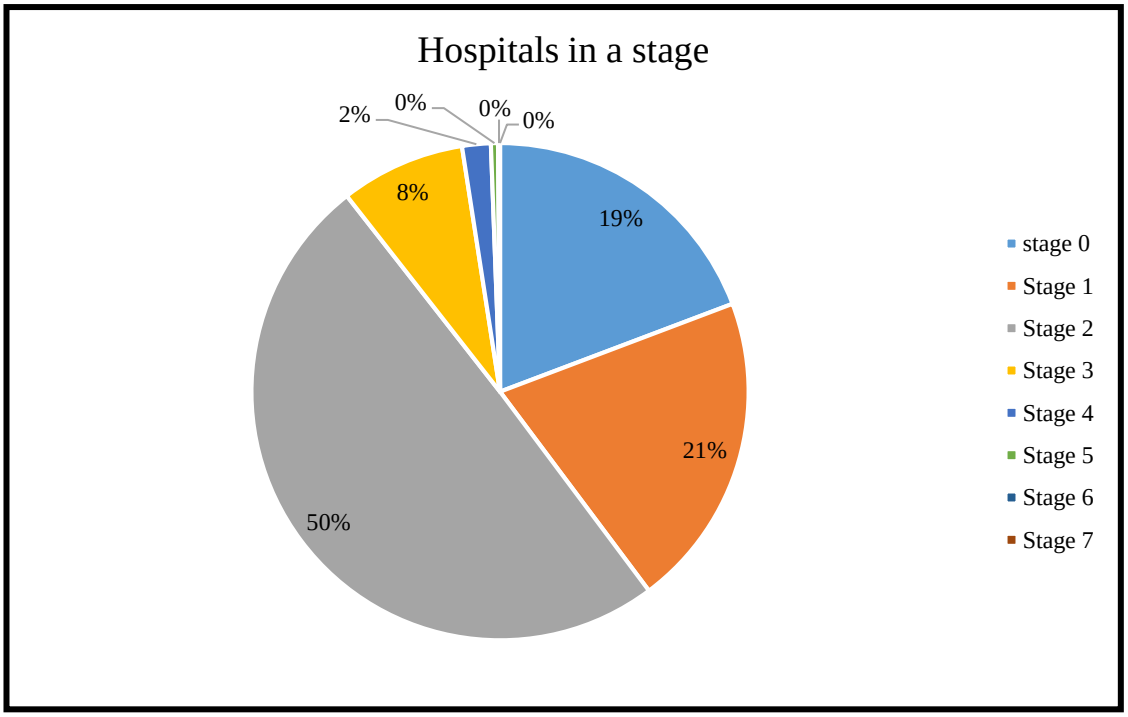
An EMR system have many technologies and capabilities that demonstrate a hospital's or physician's transition to a modern (i.e., paperless) approach to delivering healthcare services.

US EMR ADOPTION MODEL (Table 8.1) [2]

Stage	Cumulative Capabilities
Stage 7	Complete EMR, Data Analytics to improve care
Stage 6	Physician Documentation (Templates),Full CDSS, Closed loop medication Administration
Stage 5	Full R-PACS
Stage 4	CPOE, Clinical Decision Support(Clinical Protocols)
Stage 3	Clinical Documentation, CDSS (Error checking)
Stage 2	CDR, Controlled medical vocabulary, CDS, HIE Capable
Stage 1	All three ancillaries installed – Laboratory, radiology, Pharmacy
Stage 0	All three ancillaries not installed

Hospitals at Various Stages of EMR Adoption Model (Table 8.2)

Stage	Hospitals in a stage	% of 3917 total hospitals
stage 0	754	19.25%
Stage 1	804	20.53%
Stage 2	1945	49.66%
Stage 3	318	8.12%
Stage 4	73	1.86%
Stage 5	18	0.46%
Stage 6	5	0.13%
Stage 7	0	0.00%
Total	3917	100.00%



Source: HIMSS White Paper 2006

Figure: 8.2

8.2 Comparative Analysis of an EMR Software

STAGE 0

As a part of patient service, the organization has not installed three major ancillary service:

- Laboratory
- Radiology
- Pharmacy

Software Comparison

As a part of the comparative analysis, the software has a functionality of all the three major ancillary services but using it as a functionality depends on the hospitals/ healthcare providers.

STAGE 1

All the three major ancillary clinical systems installed:

- Laboratory
- Radiology
- Pharmacy

Software Comparison

Since the software already has, the functionality of these services as a part of the clinical systems and was cross checked in the previous stage as well. This indicates that the software is capable of qualifying the first stage of Electronic Medical Records Adoption Model (EMRAM).

STAGE 2

- Major Clinical systems feed data to a Clinical Data Repository (CDR) that provides physician access for reviewing all orders and results

Software Comparison

Patient Data: Data recorded for the patient as patient demographics, medical history, and previous medications by the nurse are marked as "reviewed" in the software after the review of physician. Diagnosis templates are edit and corrected depending upon the requirement.

Results & Orders: The EMR has an inbuilt feature of storing and managing the clinical data from all departments that reflects as "chart report" tab for reviewing the results, ordered tests, medications & as a part communication between the physician and patient. Orders can also be placed as a **"single orders" or "order sets & panels"** for single and multiple orders in the interface.

- CDR contains a controlled medical vocabulary, and the clinical decision support/rules engine (CDS) for rudimentary conflict checking

Software Comparison

Medical Vocabulary: As a part of clinical data repository, various standardized vocabularies are installed in the system, which helps in the interpretation and understanding of clinical data such as:

- SNOMED CT
- Code sets by Rx Norm data source providers
- CPT-4
- LOINC
- Vaccines administered (CVX)
- ICD-9-CM, ICD-10-CM/PCS

Rudimentary Conflict Checking: In the frame of conflict checking CDS functions by giving a **"POP-UP Warning"** for contraindicated medications or those not included in the hospital formulary & **"a revert back and check alert"** for the tests being ordered in case of any issues.

- Information from document imaging systems linked to the CDR at this stage.

Software Comparison

Imaging: Picture Archive and Communication Systems (PACS) as an outcome of the imaging tests performed by third-party vendors shared with the hospitals through a link as PACS operating on different software.

- The hospital may be health information exchange (HIE) capable at this stage and can share whatever information it has in the CDR with other patient care stakeholders.

Software Comparison

Health Information Exchange: Every patient stakeholder within the facility assigned limited access to the software with defined security points in the system based on their eligibility.

The above prerequisites mentioned in stage second of EMRAM model compared with the software that inferred software compliant with this stage.

STAGE 3

- Nursing/Clinical documentation
  - Vital signs
  - Flow sheets
  - Nursing sheets
  - eMAR

These documents are required and is implemented and integrated with the CDR for at least one inpatient service in the hospital.

Software Comparison

Software on behalf of nursing department shows the following:

Vital signs: A comprehensive template for recording the patient's vitals as blood pressure, pulse rate, weight, height and other vital signs.

Nursing and Flow Sheets: A daily record sheet for the routine procedures carried out in detailed format entered into the system in accordance with the change of shifts.

eMAR: Refers to the "Electronic Medication Administration Record" consisting of the ongoing prescribed medications, history of prescribed medications, contraindications and drug allergies.

- Care Plan Charting is scored with extra points

Software Comparison

A patient care plan dispatched to the patient medical record addressing the postoperative care plan along with a specific plan relating to the condition as future course of action.

- Error checking for order entry implemented as Clinical Decision Support

Software Comparison

Error Checking: For the medications ordered by the physician or other patientcare stakeholders assessed by the inbuilt clinical decision support system checking the orders in comparison:

  - Drug-drug interactions
  - Drug- food interactions
  - Drug-lab errors

That could risk the patient safety issued as a "Warning pop-up" with alternative recommendations based on the hospital formulary.

- Medical image access from picture archive and communication systems (PACS) is available for access by physicians outside the Radiology department via the organization's intranet

Software Comparison

Medical images based on the archiving facility (PACS) in the software are accessible organization wide for diagnosis through a common sharing port for consultation.

Film based diagnosis replaced with sharing through a systems network aligned with multiple modalities. These reports and results are accessible to the patients at any point of time through the **"patient chart"** sharing tab in the software.

STAGE 4

- Computerized Practitioner Order entry as an application installed in the nursing and CDR environment for creating orders by any licensed clinician as a part of clinical decision support capabilities related to evidence based medicine protocols

Software Comparison

As a part of Computerized Practitioner Order Entry, application physicians in this stage are able to schedule medication orders for specific patients by functioning on the principle of evidence based medicine protocols.

System provides the information on medication requirements and dosage according to the "criteria" set by the physician, also as an added functionality provides alerts as "Exceptions" in the medication orders.

System also derives the information based on "best practice advisory" installed in the system by the guidelines and criteria provided by the specified hospitals.

STAGE 5

- Displacement of all film based images by a full complement of radiology PACS system which provides medical images to physicians via an intranet
- Cardiology PACS and document imaging are scored with extra points

Software Comparison

Assessment of the previous stages and upgradation for upcoming stages requires complete displacement of radiology PACS which is accessible via intranet along with it PACS for cardiology is also available in a similar format in the software which provides extra score in the assessment based on EMRAM model.

STAGE 6

- For at least one inpatient care service area full physician documentation with structured templates & discrete data implemented with
    - Progress notes
    - Consultation notes
    - Discharge summaries
    - Problems list
    - Diagnosis list maintenance

Software Comparison

As a part of complete documentation, software has structured templates from which the conditions diagnosed added as "complete notes" for consultation.

The pre-existing conditions, existing conditions documented by nurse and unaddressed conditions reflected and added in the notes respectively.

A comprehensive discharge summary of complete patient data is available in the "patient charts" as postoperative and domiciliary care with precautionary future steps.

- Guidance for all clinician activities related to protocols and outcomes in the form of variance and compliance alert as a part of clinical decision support

Software Comparison

A complete system notifications and alerts on the daily procedures performed based on requirements, timely entry for the flow sheets, and alerts on variances observed in routine protocols followed, alerts on compliance because of the defined security points in the software based on eligibility.

- Implementation and integration of closed loop medication with bar coding, eMAR, Radio frequency identification (RFID) and other auto identification technologies with CPOE & Pharmacy to maximize point of care patient safety process for unit dose medication administration.

Software comparison

For enhancing patient safety based on closed loop medication software is well equipped to ensure patient safety by:

- Inferences derivation based on the patient history and present diagnosis for medication prescription
- Review by the physicians after prescribing the medications by "Sign & Release" tab
- Re-review by the pharmacists of the medications assigned by physician through the software
- Barcoding of the medications for ensuring patient safety with respect to the shelf life, efficacy and availability in the hospital formulary
- As a part of auto identification technology RFIDs utilized for each unit dose administered to the patient

- "Five Rights" of medication administration verified at the bedside with the scanning of bar code on the unit dose medication and patient ID
  - Right Patient
  - Right Drug
  - Right Dose
  - Right Route
  - Right Time

Software Comparison

The "Five Rights" are applied principally in the software as warnings, exceptions, and best practices advisory in the electronic medication administration record (eMAR) followed by the criteria and limitations set by physician and hospital formulary.

The hospital facility assures itself with the help of software about the administration of right drug to the right patient, at the right time from the right route in the right dose.

STAGE 7

- Complete transition of hospital to paperless from paper based documentation to deliver and manage patient care and has a mixture of discrete data, document images, and medical images within its EMR environment

Software Comparison

Shift from the paper based documentation environment to paperless in all clinical and non-clinical operational functionalities as a part of improving the accuracy, quality, efficiency and effectiveness of the operations

- Data warehousing utilized to analyze patterns of clinical data to improve quality of care, patient safety, and care delivery efficiency. Sharing of clinical information via standardized electronic transactions with all entities that are authorized to treat the patient, or a health information exchange

Software Comparison

Data repository as an inbuilt feature in the software, based on terminology described as Clinical Data Repository. Also in the final stage of EMR Adoption Model, software assessed is capable of complete exchange of health information with all patient stakeholders with a developed capability of Electronic Health Record (EHR) for information exchange across healthcare providers.

8.3 To assess hospitals from the client market for EMR model adoption and provide recommendations for stage upgradation

Requirement of HIMSS Stage 7

Consideration of stage 7 by HIMSS Analytics as a benchmarking tool that provides an IT strategy road map for the organization to achieve clinical and operational excellence by demonstrating a commitment to patient outcomes, satisfaction, safety and signifying a culture of adoption to innovation in the use of technology.

It makes the overall operations of the provider:

- Lean
- Efficient
- Connected
- Quality based
- High Reliability Organization (HRO)

The model emphasizes data analytics to identify opportunities/problems, monitor compliances and demonstrate outcomes based on:

- Value
- Return on Investment (ROI)
- Comparative Quality Advantage

The Assessment Process

• Stage 0 to 5 is self-assessment and mostly online

• Stage 6 is onsite visit typically with one reviewer from HIMSS

• Stage 7 is onsite visit typically with up to three reviewers: one from HIMSS and two from other hospitals

Stage 6 - Validation Process

• During quality review process to ensure the completeness of data, hospital must submit the requested data for scoring at stage 6

• Dispatch of a basic gap assessment report based on the calculated EMRAM score

• Upon meeting the required criteria, the hospital must undergo an on-site validation for grants of Stage 6. In addition, complete validation of hospital at Stage 6 to be eligible for Stage7

• Onsite validation carried out by one reviewer from HIMSS Analytics and a final report is sent within two weeks with a final decision is made at the end of visit

Stage 7- Validation Process

• An onsite visit conducted to review all criteria through Stage 7 by:

- Three reviewers
- HA Inspector

- A Chief Information Officer (CIO) from another stage 7 hospital or Stage 6 hospital if Stage 7 CIO not available
- A physician from another stage 7 hospital or Stage 6 hospital if Stage 7 not available

• With a final decision at the end of visit, HIMSS Analytics also recommends and provides on-site pre-validation consultations for both Stage 6 and Stage 7 preparations

Key Stage 7 Requirements

- Stages 3, 4, 5, 6 now must be hospital-wide
- A&E included for Stages 3, 4, 5, 6
- **>=90% CPOE** for 4 months consecutively
- For 4 months consecutively, **>=95%Barcode Enablement**: medications, Blood Products, Expressed Breast Milk (NICU Only)
- Physician Documentation driven by a "rules engine" with structured templates for capturing discrete data
- Emergency Department (ED)- LIVE with BV,CPOE, Physician Documentation (no percentage criteria required)
- All medications must be available on the eMAR or Patient Profile (Including Code & Anesthesia Medications)
- Data Analytics used to demonstrate improved outcomes as a drive to change
- Scanning of clinically relevant paper within 24 hours of creation
- CCD LIVE Exchange of information with outside organizations
- Quality and analytics program with strategy & governance for disaster recovery and business continuity
- Essentially paperless

Healthcare Provider Analysis

From the above described cliental of the organization based on the sampling technique a healthcare provider/hospital "Y" is analyzed on the defined set of criteria. With the help of system users, conducted a reporting analysis in the software for analyzing all the given parameters for the hospital studied. The parameters for the analysis of goal were the defined standardized guidelines. Period for the analysis as mentioned by HIMSS Analytics for the analysis was defined for a period of four months.

Computerized Physician Order Entry (CPOE)

Parameter	Criteria	Results
CPOE Compliance	=>90%	Total Orders=1,249,197 **CPOE Compliance=73%** Verbal=22% Written=2% Unspecified=3%

IP Barcode

Parameter	Criteria	Results
IP Barcode	=>95%	Total Administrations=9,55,492 Patient Scan Compliance= 97.42% Medication Scan Compliance= 95.15%

Barcoded Medication Administration (BCMA)

Parameter	Criteria	Results
BCMA	=>95%	Average Medication Compliance= 95.1% Average Patient Compliance= 97.4%

Structured Discrete Data

Parameter	Criteria	Results
Structured Discrete Data	~20% (No defined Threshold)	Report couldn't run

"An approved validation by HIMSS Analytics is considered valid for three years after which a revalidation is required by the provider organization to maintain the status of Stage 6 or Stage 7 of the EMR Adoption Model"

(Table 8.3)

EMR ADOPTION Model (2006-2015) United States										
STAGE	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Stage 7	0.0%	0.0%	0.3%	0.7%	1.0%	1.2%	1.9%	2.9%	3.6%	4.2%
Stage 6	0.1%	0.8%	0.5%	1.6%	3.2%	5.2%	8.2%	12.5%	17.9%	27.1%
Stage 5	0.5%	1.4%	2.5%	3.8%	4.5%	8.4%	14.0%	22.0%	32.8%	35.9%
Stage 4	3.1%	2.2%	2.5%	7.4%	10.5%	13.2%	14.2%	15.5%	14.0%	10.1%
Stage 3	18.7%	25.1%	35.7%	50.9%	49.0%	44.9%	38.3%	30.3%	21.0%	16.4%
Stage 2	40.0%	37.2%	31.4%	16.9%	14.6%	12.4%	10.7%	7.6%	5.1%	2.6%

Stage 1	17.4%	14.0%	11.5%	7.2%	7.1%	5.7%	4.3%	3.3%	2.0%	1.7%
Stage 0	20.4%	19.3%	15.6%	11.5%	10.1%	9.0%	8.4%	5.8%	3.7%	2.1%
N=	4,237	5,037	5,166	5,281	5,337	5,458	5,458	5,449	5,467	5,460

SOURCE: HIMSS ANALYTICS

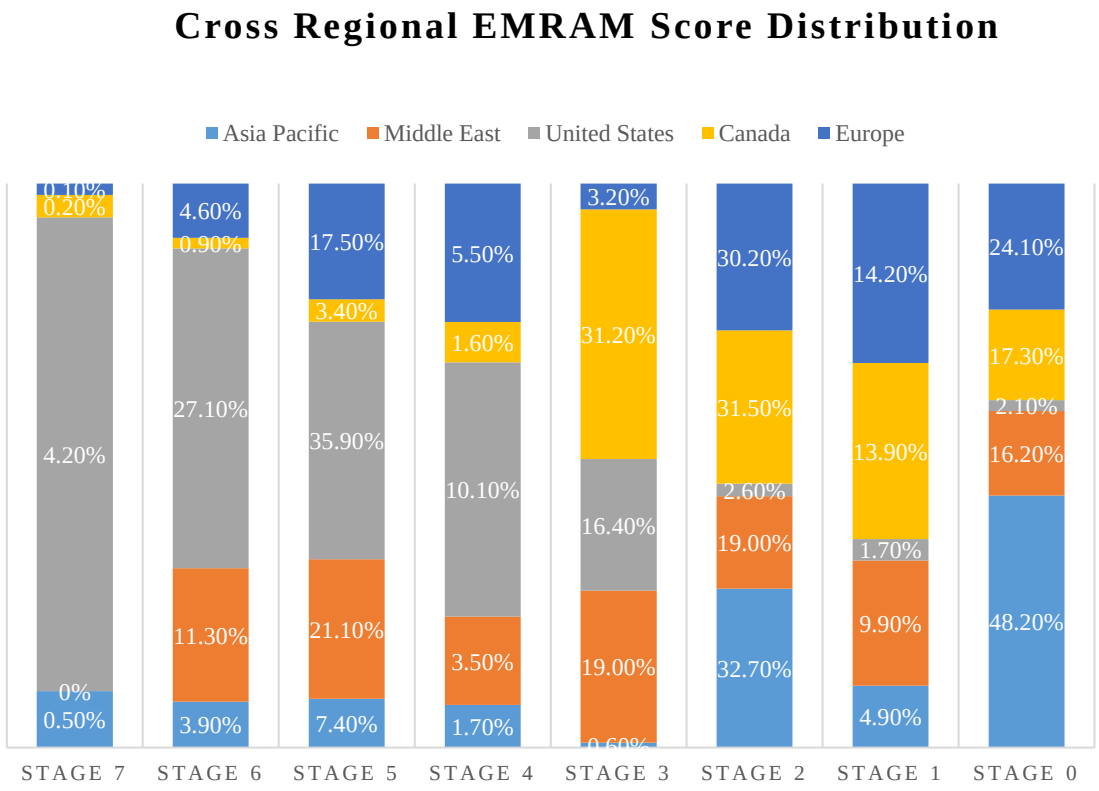


Figure: 8.3

8.4 Meaningful Use:-

Meaningful Use is a program of CMS Medicare and Medicaid that involves mainly the awards and incentives for using certified electronic health records (EHR) in order to improve the patient care. "MU" measurably improve health care quality and efficiency and enhance the use of certified EHR technologies by health care providers.[11]

Meaningful use compliances will result in:

- Clinical outcome improvement
- Population health outcomes improvement
- Increased transparency and efficiency
- Individuals empowerment
- More robust research data on health system

Stages of Meaningful Use:-

2011-2012	2014	2016
Stage 1	**Stage 2**	**Stage 3**
Data capturing and sharing	Advanced clinical processes	Improved outcomes

Meaningful Use Criteria for Eligible Hospitals:-

- 14 Core Objectives
- 5 out of 10 from menu set objectives
- 15 Clinical Quality Measures

Stages of meaningful use criteria (Table 8.5)

Stage 1	Stage 2	Stage 3
Meaningful use criteria focus on:	**Meaningful use criteria focus on:**	**Meaningful use criteria focus on:**
Standardized format to capture the health information electronically	More rigorous health information exchange (HIE)	quality, safety, and efficiency improvement which leads to improved healthcare outcomes
To track key clinical conditions use of that information	Lab results incorporation and increment in e-prescribing requirements	For national high-priority conditions incorporating decision support
Communication of information for processes of care coordination	Transmission of patient care summaries and information by electronic means across multiple settings	Access of patients to self-management tools
clinical quality measures and public health information reporting initiation	More patient-controlled data	By patient centered HIE providing access to comprehensive patient data
Engagement of patients and their families in their care by using information		Improving population health outcomes

9. Recommendations

The study shows that comparative analysis of software with the Software and the hospital facility is compliant with the EMR Adoption Model.

The reports analyzed from the software showed that Computerized Physician Order Entry (CPOE) is not compliant for the set criteria by HIMSS Analytics at stage 7.

- Hospital should emphasize monitoring and enhanced adaption for the entry of orders based on software
- Orders entry through verbal unstructured methods should be reduced to assure the compliance

10. Discussion

The qualitative findings map to multiple theoretical factors, which facilitates the study with a complete understanding of every stage for the EMRAM model. Discussing about multiple terminologies such as CDSS, CMV, and CPOE etc., which forms a comprehensive base for the understanding of EMR adoption model, its stages, compliance requirements for an EMR to achieve the ultimate aim of a completely paperless healthcare system with functionalities being implemented at each step of model. Findings infer that the software compared in the study is robust enough to comply with the standards of the suggested model but review of literature also suggests that even if a healthcare provider/hospital is implementing the software partially and simultaneously working on other software through interfaces is also feasible enough to comply with the stage requirements. The study also undergoes limitations based on the non-disclosure clause because of which the name of EMR software, client name and the name of hospital/ healthcare provider could not be disclosed. As a part of pre-requisites, there are multiple factors, which are studied and can be assessed but as a part of internal assessment, only a few parameters are analyzed out of which compliance requirements are partially fulfilled and a few factors are found non-compliant.

11. Conclusion

The Electronic Medical Records Adoption Model provides a basis for the integration of technology with healthcare services by providing a medium for assisting all the stakeholders at every stage of the model. In transition from basic ancillary services to creating a completely paperless environment, which facilitates to improve the delivery of healthcare services, enhances the efficiency of operations and provides a concrete basis for patient medication and treatment since software functioning is driven by evidence of data in software.

Following the EMRAM model apart from enabling a paperless environment, creates a standardized platform for the healthcare providers worldwide for the adoption of model. Simultaneously, the model also has incentives associated and a recognition attached for reaching stage 7, which drives the healthcare providers in US for adaption of EMR Model and setting a benchmark for making the entire health systems robust and efficient.

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13. Annexure

- **Checklist**

Stage 0: Ancillaries Uninstalled

	Laboratory
	Radiology
	Pharmacy

Stage 1: Ancillaries Installed

	Laboratory
	Radiology
	Pharmacy

Stage 2: Clinical Data Repository, Controlled medical vocabulary, Clinical Decision Support, Health Information Exchange Capable

	Data fed to CDR from major ancillary clinical systems for reviewing of orders and results by physicians
	CDR for Rudimentary conflict checking
	Document imaging system linked with CDR
	Health information exchange capable

Stage 3: Clinical Documentation, CDSS (Error Checking)

	Nursing, Clinical documentation implementation and integration with CDR for at least one inpatient service in hospital
	Electronic Medication Administration Record application (eMAR) is implemented
	Error checking for order entry is implemented as Clinical Decision Support
	Medical image access from picture archive and communication systems (PACS) is available for access by physicians outside the Radiology department via the organization's intranet

Stage 4: Computerized Physician Order Entry; Clinical Decision Support Protocols

	Computerized Practitioner Order entry as an application installed in the nursing g and CDR environment for creating orders by any licensed clinician as a part of clinical decision support capabilities related to evidence based medicine protocols
	Stage can be marked as achieved if the previous stages are completed and one inpatient service area has implemented CPOE with physicians entering orders

Stage 5: Full R-PACS

	Displacement of all film based images by a full complement of radiology PACS system which provides medical images to physicians via an intranet
	Cardiology PACS and document imaging are scored with extra points

Stage 6: Physician Documentation (Templates), Full CDSS, Closed Loop Medication Administration

	For at least one inpatient care service area full physician documentation with structured templates & discrete data implemented with progress notes, consult notes, discharge summaries, problem list and diagnosis list maintenance
	Guidance for all clinician activities related to protocols and outcomes in the form of variance and compliance alert as a part of clinical decision support
	Complete Implementation of closed loop medication administration with bar coded unit dose medications environment
	Implementation and integration of eMAR and bar coding or RFID with CPOE and pharmacy to maximize point of care patient safety processes for medication administration
	Verification and application of “five rights” of medication as a principle in the software at the bedside with scanning of the bar code on the unit does medication and the patient ID.

Stage 7: Complete EMR, Data Analytics to Improve Care

	Complete transition of hospital to paperless from paper based documentation to deliver and manage patient care and has a mixture of discrete data, document images, and medical images within its EMR environment
	Data warehousing utilized to analyze patterns of clinical data to improve quality of care, patient safety, and care delivery efficiency
	Sharing of clinical information via standardized electronic transactions (i.e., CCD) with all entities that are authorized to treat the patient, or a health information exchange (i.e., other non-associated hospitals, ambulatory clinics, sub-acute environments, employers, payers and patients in a data sharing environment)
	Demonstration of summary data continuity for all hospital services by the hospital (e.g., inpatient, outpatient, ED, and with any owned or managed ambulatory clinics).
	Inclusion of blood products and human milk in the closed-loop medication administration process

- **Workflows**
  - **General Patient Workflow**

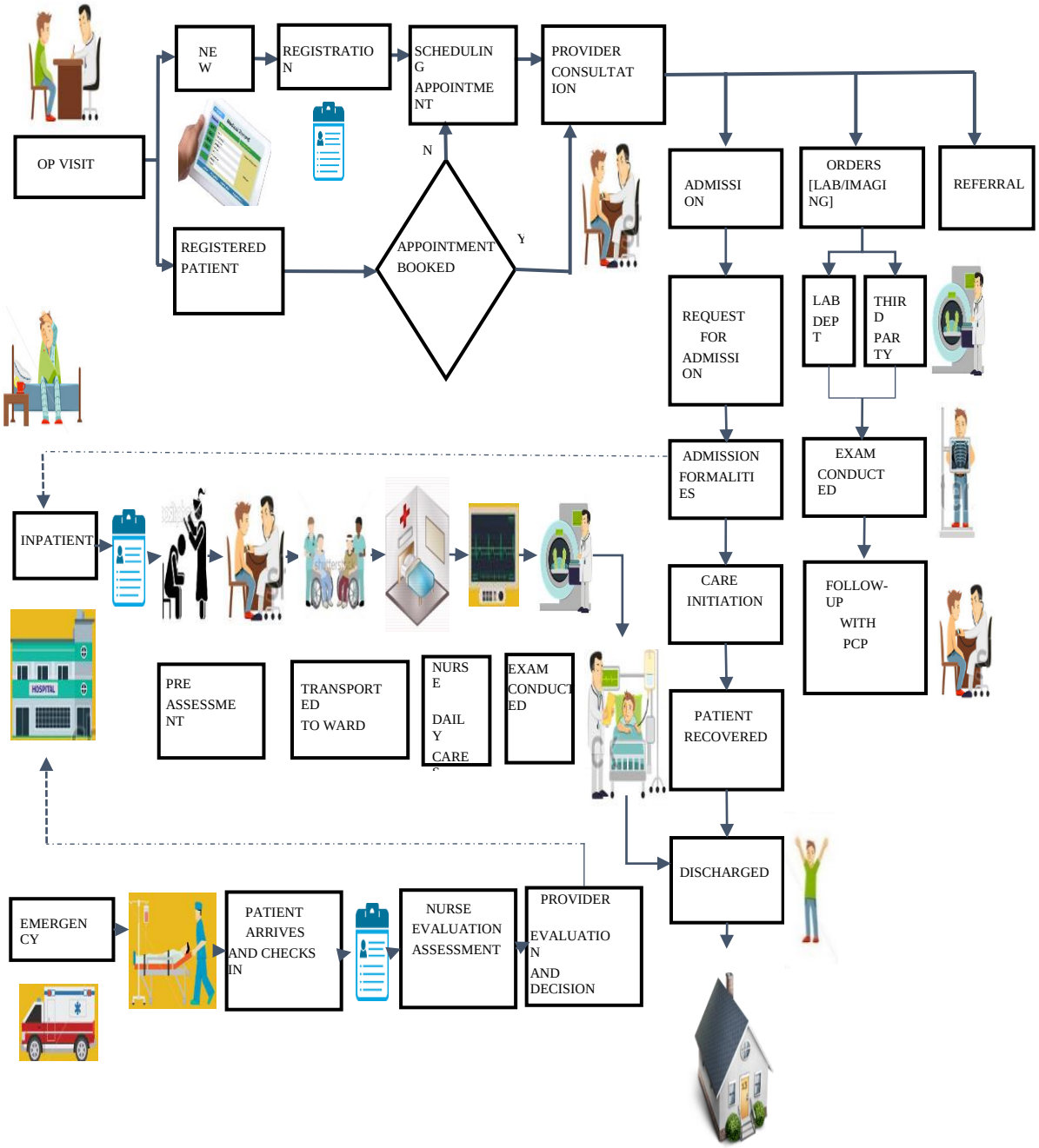

Figure: 13.1

- **OPD Pharmacy Workflow**

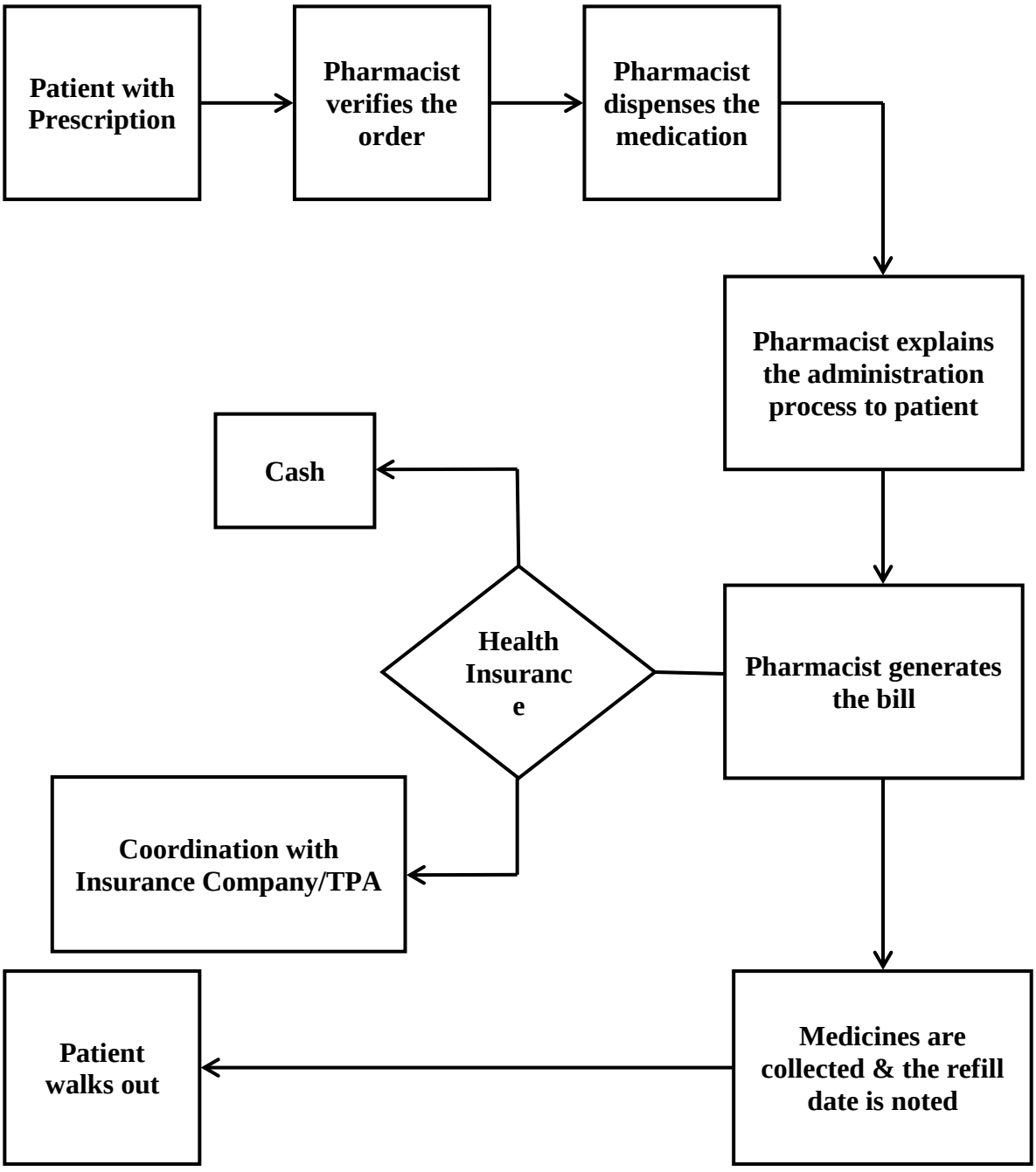

Figure: 13.2

- **IPD Pharmacy Workflow**

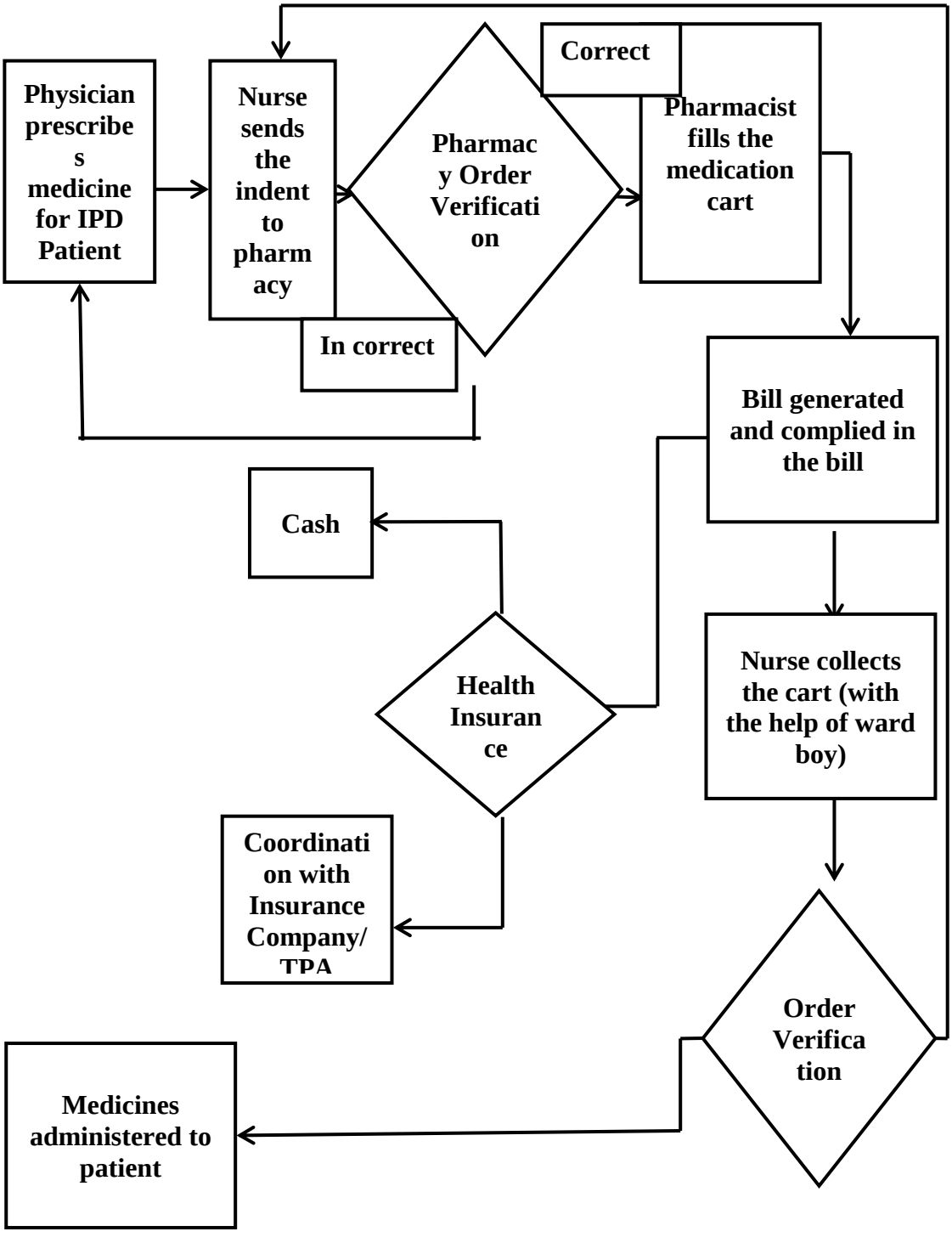

Figure: 13.3

- **IPD Radiology Workflow**

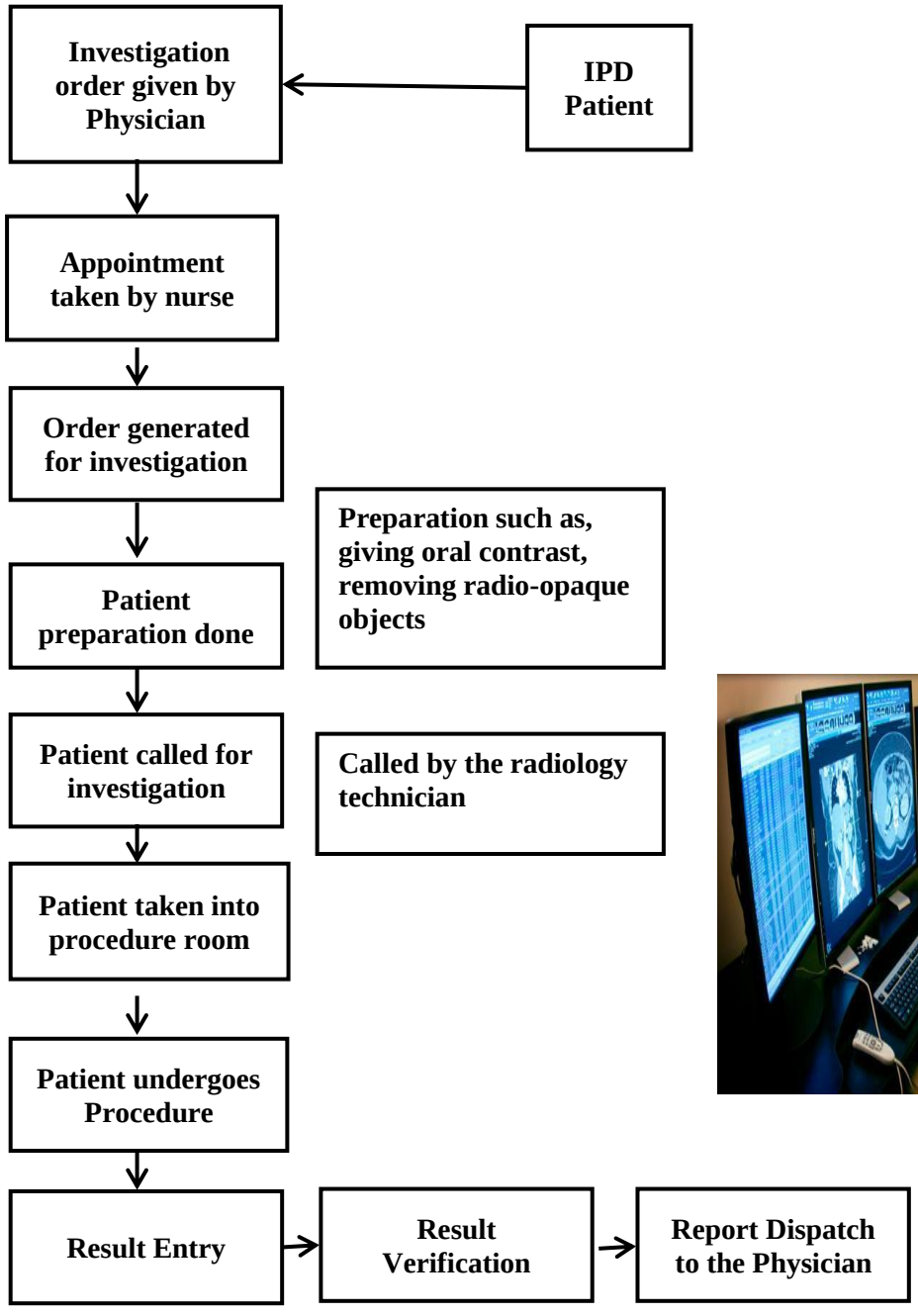

Figure: 13.4

- **OPD Radiology Workflow**

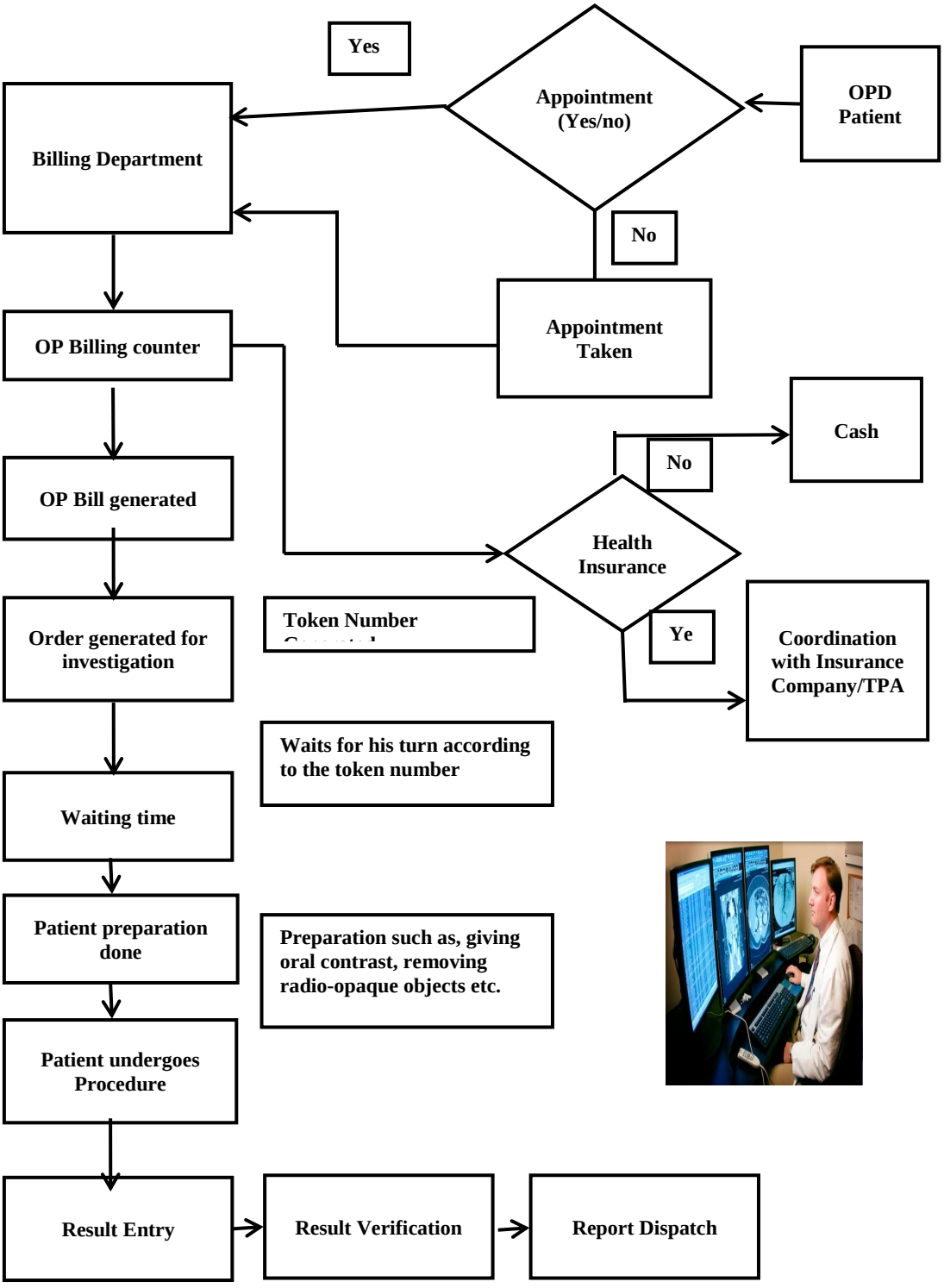

Figure: 13.5

- **Laboratory Workflow**

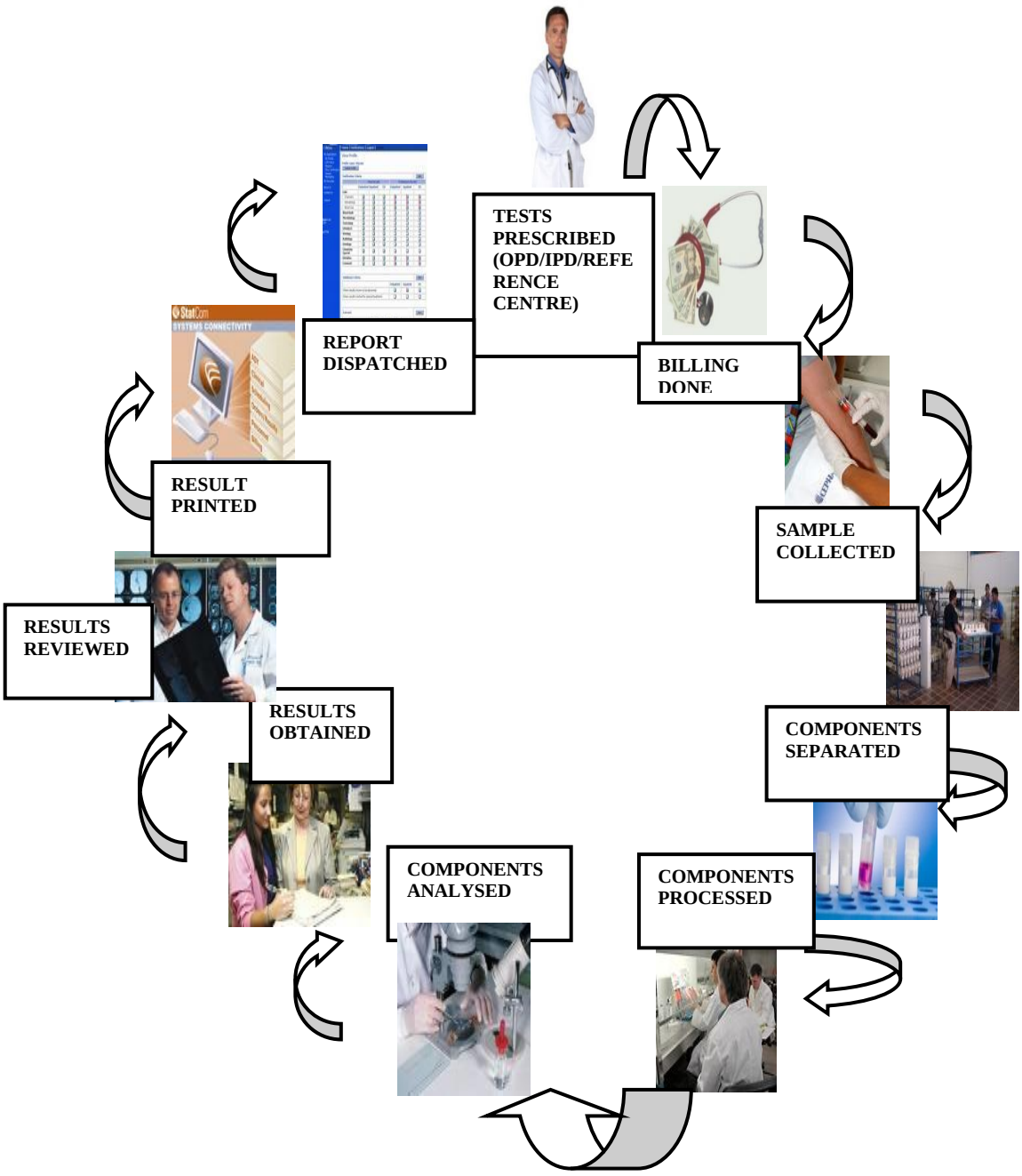

Figure: 13.6